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Proceedings of the zonal peer review meeting on the redfish stock assessment in Units 1 and 2

March 3, 2016
Mont-Joli, Quebec

Chairperson: Martin Castonguay
Rapporteur: Sonia Dubé

Maurice Lamontagne Institute
Fisheries and Oceans Canada
850 Route de la Mer, P.O. Box 1000
Mont-Joli, Quebec G5H 3Z4

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Foreword

The purpose of these Proceedings is to document the key activities and discussions of the meeting. The Proceedings may include research recommendations, uncertainties and the rationale for decisions made during the meeting. The Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. Therefore, interpretations and opinions presented in this report may be factually incorrect or misleading, but are included to record, as faithfully as possible, what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available within the time frame of the meeting. In the rare case when there are formal dissenting views, these are also archived as Appendices to the Proceedings.

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SUMMARY

This document contains the proceedings from the zonal assessment process on Redfish in Units 1 and 2. This review process was held on March 3, 2016 at the Maurice Lamontagne Institute in Mont-Joli. This meeting included thirty participants from science, management and industry. These proceedings contain the key points of the presentations and discussions, and report the recommendations and conclusions agreed upon during the review.

SOMMAIRE

Ce document renferme le compte rendu de la réunion tenue dans le cadre du processus zonal d'évaluation des stocks de sébaste des unités 1 et 2. Cette revue, qui s'est déroulée le 3 mars 2016 à l'Institut Maurice-Lamontagne à Mont-Joli, a réuni une trentaine de participants des sciences, de la gestion et de l'industrie. Ce compte rendu contient l'essentiel des présentations et des discussions qui ont eu lieu pendant la réunion et fait état des recommandations et conclusions émises au moment de la revue.

INTRODUCTION

The Quebec and Newfoundland and Labrador Regions of the Department of Fisheries and Oceans (DFO) are responsible for assessing the stocks of several fish and invertebrate species harvested in the Estuary and Gulf of St. Lawrence. Most of these stocks are assessed periodically within a regional or zonal science advisory process. This document consists of the proceedings of the meeting on zonal Redfish stock assessment in Units 1 and 2 held on March 3, 2016, at the Maurice Lamontagne Institute in Mont-Joli, Quebec.

The objective of the review was to determine whether there were any changes in the resource status and whether adjustments were required to the management plans based on the chosen conservation approach, the ultimate goal being to provide scientific advice on managing the redfish stocks in Units 1 and 2 for the 2016 and 2017 fishing seasons.

These proceedings report on the main points discussed in the presentations and deliberations stemming from the stock assessment review. The zonal review is a science process open to participants by invitation only, who are able to provide a critical outlook and knowledge of the status of the assessed resources. Accordingly, participants from outside DFO are invited to take part in the meeting's activities within the defined framework for this review (Appendices 1 and 2). The proceedings also list the recommendations made by the meeting.

BACKGROUND

The meeting chairperson, Martin Castonguay, summarized the peer review objectives and process. Hugo Bourdages highlighted the help of various collaborators and provided a bit of background information. The last redfish stock assessment in Units 1 and 2 was in 2010. These two units were grouped as a single biological unit for each of the two species, and each species was assessed separately. The same indices will be reviewed in this assessment, and the main question is, "When will the small redfish be recruited to the fishery?" At the December 2015 zonal assessment framework meeting, new modelling approaches to assess the status of redfish populations in Units 1 and 2 were presented. Unfortunately, none of the models presented allowed the data to be adjusted appropriately, and additional work is required to improve these models.

Alexandra Valentin presented a few components of redfish biology: distribution, criteria for distinguishing the species, habitat, diet, growth and reproduction. The two species of redfish are distributed according to depth. In summer surveys, *Sebastes fasciatus* dominates water depths of less than 300 m, along the slopes of channels and on banks, except at the Laurentian Fan where it is found in deeper waters. *Sebastes mentella* mostly predominates in the main channels at depths of over 300 m. Recent analysis of stomach contents indicates that shrimp are likely an important prey, especially for large redfish.

- Clarification is made regarding species discrimination, which is mainly based on the number of soft rays of the anal fin. There are generally 7 in *S. fasciatus* and 8 in *S. mentella*, but this may vary. A correction was made regarding the difference between the theoretical range and the actual range observed based on a sample. This approach, which included a depth criterion, was used in the analyses.
- In addition, for *S. mentella*, a specific signature is observed that includes a heritage of introgressive hybridization passed down from generation to generation. These individuals are considered *S. mentella*.

Mr. Bourdages gave a brief overview of the oceanographic conditions. A warming of the deep waters of the Gulf of St. Lawrence to more than 6°C is observed.

- We are seeing the same types of positive anomalies (warm events) as in the 1980s, which may explain the increase in recruitment.
- New cohorts were observed arriving (2011, 2012 and 2013), which is very encouraging.

ASSESSMENT OF THE RESOURCE

DESCRIPTION OF THE FISHERY

Johanne Gauthier described the fishery. From 2010 to 2015 (the 2014 and 2015 data are preliminary), average annual landings were 481 t in Unit 1 out of an annual TAC of 2,000 t. Over the same period, average landings in Unit 2 were 3,775 t out of an annual TAC of 8,500 t. Industry reported that market conditions and restrictions related to management measures had a major effect on catches. Since 2004, the performance index for bottom trawls in the index fishery has been stable and comparable to the average in Unit 1. There is no performance index available for Unit 2.

Daniel Duplisea conducted a modelling exercise using interviews with fishers to reinterpret the catches in Units 1 and 2 in the 1980s and 1990s. He found that catches between 1988 and 1993 could be much greater than reported, and that the proportion of individuals <20 cm was likely greater than indicated.

Information on bycatch by shrimp harvesters was presented briefly, but its impact seems relatively low.

- It should be noted in the sources of uncertainty that a large part of Unit 1 is not covered by the index fishery. Industry representatives think that a larger fishery should be allowed in Unit 1, which would provide more data and a better picture of the situation. However, this request should be addressed to Management.
- The selectiveness of the mesh size (90 mm) of nets was discussed; it seems it is not ideal for avoiding small redfish. Certain areas had to be closed to reduce catches of small redfish.
- The lack of surveillance around 1986 was mentioned; this could have led to more catches than reported. It seems that the fishing effort was considerable because there were a number of markets.

SCIENTIFIC SURVEYS: DFO – UNIT 1; GEAC – UNIT 2

The abundance indices from the scientific surveys were provided for each Unit (1 and 2) separately and for both units combined, for each species: *S. fasciatus* and *S. mentella*. A model to convert data from the GEAC survey to their Teleost equivalents was presented; its purpose is to make the time series continuous and to allow data from Unit 2 to be compared with data from Unit 1.

The abundance of juvenile redfish, largely dominated by *S. mentella*, increased significantly in the research surveys starting in 2013. In the northern Gulf of St Lawrence, the abundance of juvenile *S. mentella* and *S. fasciatus* was 80 and 4 times higher, respectively, than their average abundance for 1993–2012. The first strong cohort, from 2011, had a modal size of 17 cm in summer 2015.

The spawning stock biomass of *S. mentella* and *S. fasciatus* estimated in the research surveys declined in the early 1990s to its lowest observed values and has remained stable up to the present.

- There is high confidence in the method for distinguishing the species. A comparison with microsatellite markers confirmed the validity of this method.
- According to participants, it seemed that in the 2010s, the right conditions converged to allow for the survival and growth of larvae and young juveniles (0+).
- Participants said that *S. fasciatus* in the Laurentian Fan area did not belong to the stock in Units 1 and 2, but to 3LNO stock, which would explain why some strong year classes have disappeared from the Gulf before reaching adulthood.

PRECAUTIONARY APPROACH

Daniel Duplisea briefly described the development of the precautionary approach, for which the reference points are derived from a surplus production model. Based on this approach, despite the potential for strong recruitment, the spawning stock biomass for both species is still in the critical zone.

- Participants wondered about the impact on the model of under-estimation of catches from 1988 to 1993. Whatever the answer, the results for recent years remain low.
- It seemed that the production model will not be able to adjust properly to the significant changes anticipated to come.

RECRUITMENT PROSPECTS

Alexandra Valentin reviewed the population structure and Mr. Duplisea presented the recruitment prospects.

The strong year classes of *S. mentella* from 2011 and 2012 have the genetic signature of the adult population of Units 1 and 2. The 2011 cohort seems to be as abundant as the last strong cohort of *S. mentella* (1980) that significantly contributed to the fishery and adult population in Units 1 and 2. The *S. fasciatus* juveniles observed in the last surveys have the genetic signature of the adult population of Units 1 and 2. In comparison, the strong cohorts of *S. fasciatus* from 1973, 1985, 1988 and 2003 observed at the juvenile stage in Unit 1 had the genetic signature of the southern edge of the Grand Banks population.

Based on the growth estimates for redfish and the hypothesis of a balanced population, almost 50% of the fish in the 2011 cohort should be over 22 cm, the minimum harvest size, by 2018. By 2020, 51% of fish in the 2011 cohort should be over 25 cm, the size at sexual maturity.

- Industry questioned the margin of error on the recruitment prospects presented. It appeared difficult to estimate.
- There is definitely uncertainty. The model does not take into account, for example, environmental variables or changes in the ecosystem. Discards are not considered either. This is a simple model of overall production which does not take into consideration age-specific effects of recruitment and growth.

REDFISH MIGRATION IN 3Pn, 4Vn

A request was submitted for advice on the appropriate changes to the current fisheries closing periods related to the mixing period in 3Pn and 4Vn. Redfish migrate to the Cabot Strait area in winter and return in spring. Migration can begin as early as November. Copulation takes place

from September to December, and larvae are released during the short period from the end of April to the beginning of June.

- Science has no new information on this topic. The measures in place seem to give good results, but any further conclusions cannot be made.
- The question of whether to extend the fishing season should be addressed to Management. Management representatives were wondering about the history of previous decisions. Clarification is needed.

CONSIDERATIONS FOR THE NEXT ASSESSMENT

The following should be considered for the next assessment:

- Pertaining to the development of an assessment model, agreement on the variables to be included and the scenarios to model will be required.
- The reference points in the precautionary approach will need to be updated.
- Sampling rules will also need to be developed.

RESEARCH TO CONSIDER

The following issues were raised as research priorities:

- Stock structure (catch, survey).
- Stock structure in the Laurentian Fan area.
- Recruitment dynamics.
- The return of a groundfish-dominated ecosystem.

NEXT ASSESSMENT YEAR AND INTERVAL YEAR

The next assessment is scheduled for winter 2018. In the fall of 2016, the DFO survey indicators (CPUE, length frequency, catch distribution) will be updated.

CONCLUSION

SUMMARY AND RECOMMENDATION

The bullets of the review were presented for discussion. Some were eliminated and others were revised. Only the comments about content are reported.

- Regarding the indices from the fishery, the factors that affect landings with the industry were discussed. Participants agreed that market conditions and restrictions related to management measures had a major effect on catches.
- The sources of the data referred to in the bullet need to be clearly specified.
- In the bullet on indices from research surveys, participants suggested specifying that it was not possible to separate the species in the 2014 Unit 2 survey.
- In the bullet on recruitment to the fishery, participants mentioned that recruits were starting to be caught at sizes under 22 cm.

- Participants suggested adding a bullet on the impact on the ecosystem of the arrival of new strong cohorts. The suggested wording is as follows: "The arrival of strong redfish cohorts will most likely have a significant impact on the ecosystem in the area, especially due to increased predation on small invertebrates and fish."

The last bullet provides a good summary of the situation and expresses the main concerns of Science:

The redfish stock outlook for Units 1 and 2 is very encouraging in the short term due to the strong cohorts from 2011, 2012 and 2013. These fish will start significantly recruiting to the fishery from 2018 to 2020, which could lead to a rapid increase in the spawning biomass. Until then, bycatch of redfish under 22 cm should be minimized.

Current harvesting has not led to an additional decrease in the spawning biomass since the last assessment. The outlook is good for recruitment to the fishery for 2018 and increase in the mature biomass for 2020 for both species. Currently, the main concern is to maximize the survival of this potential recruitment for the next five years.

APPENDICE 1- LIST OF PARTICIPANTS

Name	Affiliation
Bourdages, Hugo	DFO – Science - Quebec
Brulotte, Sylvie	DFO – Science - Quebec
Castonguay, Martin	DFO – Science - Quebec
Chiasson, Hector	ACAG
Coffin, David	DFO – Resource Management - NL
Cotton, Allen	ACPG
Coulombe, Francis	Merinov
Cyr, Charley	DFO – Science - Quebec
Delaney, Paul F.	Madelipêche
Desgagnés, Mathieu	DFO – Science - Quebec
Doniol-Valcroze, Thomas	DFO – Science - Quebec
Dubé, Sonia	DFO – Science - Quebec
Duplisea, Daniel	DFO – Science - Quebec
Gauthier, Johanne	DFO – Science - Quebec
Gendreau, Yanick	DFO – Science - Quebec
Grelon, Damien	Merinov
Hurtubise, Sylvain	DFO – Science - Quebec
Konrad, Christoph	Memorial University
Lambert, Yvan	DFO – Science - Quebec
Mélançon, Josiane	DFO – Science - Quebec
Nozères, Claude	DFO – Science - Quebec
Parent, Éric	DFO – Science - Quebec
Power, Don	DFO – Science - NL
Robert, Dominique	Memorial University
Sainte-Marie, Bernard	DFO – Science - Quebec
Valentin, Alexandra	DFO – Science - Quebec
Van Beveren, Elisabeth	DFO – Science - Quebec
Vascotto, Kris	GEAC
Voutier, Jan	GEAC
Winger, Paul	Memorial University

APPENDICE 2- TERMS OF REFERENCE

Assessment of Redfish stocks (*Sebastes mentella* and *S. fasciatus*) in Units 1+2

Zonal Peer Review – Quebec and Newfoundland and Labrador Regions

March 3, 2016
Mont-Joli (Québec)

Chairperson: Martin Castonguay

Context

Units 1 + 2 Redfish (*Sebastes* spp.) are distributed in the Gulf of St. Lawrence as well as the Laurentian Channel and Laurentian Fan areas off southern Newfoundland and Northeastern Nova Scotia. Both *S. fasciatus* and *S. mentella* in these areas are considered to be in a low relative biomass state and a 2012 peer review meeting showed them to be in the precautionary approach critical zone at 44% and 8% of their biomass limit reference points, respectively. These long lived species have proven difficult to age and age based modelling approaches have not as yet been applied successfully to either of these stocks. Reference point estimates from these stocks are the result of fitting a state-space Bayesian implementation of the Schafer surplus production model, BSP (McAllister and Duplisea 2011, 2012). BSP does not make use of the length composition data available for these stocks and it was agreed at the 2012 reference point meeting that further approaches would be considered that could include these data in hopes of more accurately modelling population dynamics and improving management advice. During a zonal peer review meeting held in December 2015, new modeling approaches have been reviewed to assess the status of Units 1 and 2 redfish populations. Unfortunately, none of the models presented adequately fit the data and further work is required to improve the models. In order to provide advice to fisheries management for the next two years, it was recommended to assess the state of the redfish populations based on indicators.

Objectives

Provide scientific advice on Units 1 and 2 redfish stock status. To the extent possible, evaluate separately the status of *Sebastes mentella* and of *Sebastes fasciatus* for Units 1 and 2 combined. This advice shall include:

- Description of the biology of Units 1 and 2 redfish and its distribution;
- A summary of oceanographic conditions;
- Description of the redfish fishery including landings, fishing effort, catch per unit effort, biological data and redfish by-catches in other fisheries;
- An update of abundance and biomass indices derived from DFO and industry surveys (including size structure and geographic distribution of catch);
- Expectations for 2011 and 2012 year class impacting the status of the stock as the cohort recruits to the fishery.
- Review available information on migration of redfish into 3Pn, 4Vn and advice on any appropriate changes to the current fishery closure associated with the mixing period in 3Pn, 4Vn.
- Identification of basic elements to consider for the next assessment;
- Evaluation of the need to follow the stock status during interim years and identification of indicators as appropriate;

- Determination of the next assessment year;
- Identification and prioritization of elements to improve and research projects to be considered for the future;
- Harvest advice for 2016 and 2017 based on available data. Harvest advice should also be communicated taking into consideration the context of two redfish species and two management units (Units 1 and 2).

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Participation

- Fisheries and Oceans Canada (DFO) (Science and Ecosystems and Fisheries Management sectors)
- Aboriginal Communities/Organizations
- Provincial Representatives
- Fishing Industry
- Academics and Other External Experts

References

McAllister, M. and Duplisea, D.E. 2011. Production model fitting and projection for Atlantic redfish (*Sebastes fasciatus* and *Sebastes mentella*) to assess recovery potential and allowable harm. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/057 vi + 75 p.

McAllister, M. and Duplisea, D.E. 2012. Production model fitting and projection for Acadian redfish (*Sebastes fasciatus*) in Units 1 and 2. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/103 iii + 34 p.